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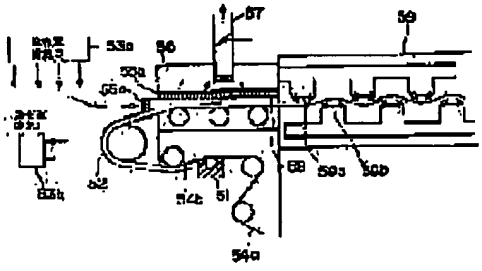
(54) PRODUCTION OF LONG-SIZED OPTICAL COMPENSATION SHEET



(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method for producing a long-sized optical compensation sheet by which an optial compensation sheet ensuring an increased angle of a visual field, causing no unevenness in an image and having a large area can be industrially and efficiently produced.
SOLUTION: In a process 51, a long-sized transparent resin film 54a with an oriented film is conveyed and the surface of the oriented film is continuously coated with a coating soln. prepd. by dissolving a liq. crystal-like discotic compd. in a solvent. In a process 56, the solvent in a formed coating layer is evaporated under control while sealing the surface of the coating layer with the layer of gas. In a process 59, the coating layer freed of most of the solvent by evaporation is converted into a discotic nematic liq. crystal layer by heating.

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CLAIMS

[Claim(s)]

[Claim 1] The process continuously applied to the orientation film front face of the long picture-like transparence resin film equipped with the orientation film which is under conveyance about the coating liquid which comes to dissolve a liquid crystallinity discotheque compound in a solvent, The manufacture approach of the long picture-like optical compensation sheet which consists of considering as the liquid crystal layer of a discotheque pneumatic phase by heating the process which evaporates a solvent under control while carrying out the seal of the front face of the formed spreading layer in a gas layer, and the spreading layer which evaporated most solvents.

[Claim 2] The manufacture approach of the long picture-like optical compensation sheet according to claim 1 to which the seal of the gas layer of the above-mentioned spreading layer front face is moved along the front face of a spreading layer so that it may become

the relative velocity of -0.1-0.1m/second to the passing speed of a spreading layer about a gas.

[Claim 3] The manufacture approach of a long picture-like optical compensation sheet according to claim 1 that the reduction rate of the content of the solvent in a spreading layer performs the process which evaporates the above-mentioned solvent under control within time amount and the period in proportionality.

[Claim 4] The manufacture approach of a long picture-like optical compensation sheet according to claim 1 that the coating liquid of this liquid crystallinity discotheque compound contains the discotheque compound 15 to 50% of the weight.

[Claim 5] The manufacture approach of the long picture-like optical compensation sheet according to claim 1 performed giving hot blast or far infrared rays to the side which does not have the liquid crystal layer of this transparence resin film for heating of this spreading layer, or by contacting a heating roller.

[Claim 6] The manufacture approach of a long picture-like optical compensation sheet according to claim 1 of performing heating after drying this spreading layer by giving hot blast or far infrared rays to both sides of this transparence resin film.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] About the manufacture approach of an optical compensation sheet, especially this invention relates to the manufacture approach of a useful optical compensation sheet, in order to improve display contrast and the viewing-angle property of a foreground color.

[0002]

[Description of the Prior Art] Generally the liquid crystal display with the big advantage of a thin shape, a light weight, and a low power is especially used as a portable word processor or a display of a personal computer to CRT (Cathode-ray tube) which is a Braun-tube mold image display device. Many of liquid crystal display components (Following LCD is called) which are carrying out current spread use the torsion nematic liquid crystal. Generally such a liquid crystal display component consists of a polarizing plate prepared in a liquid crystal cell and its both sides. The means of displaying using such liquid crystal can be divided roughly into two methods in birefringence mode and rotatory-polarization mode.

[0003] The super TSUISU Ted nematic liquid crystal which has angle of torsion and the steep electro-optics property exceeding 90 degrees is used for the super-torsion (super TSUISU Ted) nematic liquid crystal display (STN-LCD is called below) using birefringence mode. For this reason, the mass display by time-sharing drive is possible

for such STN-LCD. However, it is in yellow mode (yellowish green/navy blue) and blue mode (blue / light yellow) that practical contrast is acquired by STN-LCD, and it needed to form the phase contrast plate (a uniaxial-stretching polymer film and liquid crystal cell for compensation) for obtaining monochrome mode. In the rotatory-polarization mode which is a display mode of TN-LCD, high-speed responsibility (dozens mses) and high contrast are acquired. Therefore, rotatory-polarization mode is advantageous in many respects compared with birefringence mode or other modes. However, since TN-LCD is not equipped with the phase contrast plate like STN-LCD, it has the problem which changes with include angles in case a foreground color and display contrast look at a liquid crystal display with it being easy (angle-of-visibility property).

[0004] In order to improve the angle-of-visibility property in above-mentioned TN-LCD (namely, expansion of an angle of visibility sake), the proposal that a phase contrast plate (optical compensation sheet) is formed between the polarizing plate of a pair and a liquid crystal cell is indicated by JP,4-229828,A and JP,4-258923,A. The phase contrast plate proposed in the above-mentioned official report compensates the phase contrast which phase contrast discovers when it leans and is generated now by the liquid crystal cell although an optical operation is not given at all from the front since vertical phase contrast is about 0 to a liquid crystal cell.

[0005] It had the negative birefringence in JP,6-75115,A, JP,4-169539,A, and JP,4-276076,A, and the optical axis leans to them, and the optical compensation sheet is indicated. That is, the above-mentioned sheet is manufactured by extending polymers, such as a polycarbonate and polyester, and has the direction of the principal indices of refraction which inclined from the normal of a sheet. Since very complicated extension processing is needed in order to manufacture the above-mentioned sheet by extension processing, it is very difficult to manufacture by the approach which is having the optical compensation sheet of a large area indicated.

[0006] On the other hand, the optical compensation sheet using a liquid crystallinity polymer is also known. For example, the optical compensation sheet obtained by applying to the orientation film front face on a support film the polymer which has liquid crystallinity is indicated by JP,3-9326,A and JP,3-291601,A. However, at an elevated temperature, in order to carry out orientation of the polymer which has liquid crystallinity, since aging of long duration is required, productivity is very low and it is not fit for mass production method. Moreover, the optical compensation sheet (birefringent plate) which becomes JP,5-215921,A from the polymerization nature cylindrical compound which has a base material, liquid crystallinity, and a forward birefringence is indicated. This optical compensation sheet is obtained by the base material spreading and by carrying out heat hardening in the solution of a polymerization nature cylindrical compound. However, since the polymer which has this liquid crystallinity is optically uniaxial [forward] optically, it can hardly expand an omnidirectional angle of visibility.

[0007] Then, the optical compensation sheet with which the orientation film was formed on the transparence resin film, and the layer of a liquid crystallinity discotheque compound was formed on the orientation film as an optical compensation sheet which the omnidirectional angle of visibility expanded by the easy process is also known (EP0646829A1 public-presentation specification).

[0008] However, although it is necessary to form the layer of a liquid crystallinity

discotheque compound by uniform thickness on the film of a large area in order to create the optical compensation sheet of a large area, it is difficult to obtain such a layer by the conventional spreading and the desiccation approach. For example, the uneven orientation of uneven distribution of thickness or a liquid crystal molecule is looked at by the liquid crystal layer obtained when it dries by applying continuously the coating liquid containing a liquid crystallinity discotheque compound, and ventilating on it, making a long picture-like film (film which has the orientation film) convey, and when the optical compensation sheet which has such a liquid crystal layer is built into a liquid crystal display, there is a problem that nonuniformity occurs in the display screen.

[0009]

[Problem(s) to be Solved by the Invention] this invention person examined many things that the uneven distribution of thickness and the cause of the uneven orientation of a liquid crystal molecule which are generated in the liquid crystal layer obtained by applying continuously and drying the coating liquid which contains a liquid crystallinity discotheque compound using a wire bar spreading machine etc. should be studied. And as a result of repeating many experiments, after applying the coating liquid of a liquid crystallinity discotheque compound, the ventilation performed into the desiccation process which evaporates the solvent in a spreading layer until it heats in order to make a discotheque pneumatic phase form in liquid crystal became clear [that the above-mentioned defect will be given to a liquid crystal layer].

[0010] Therefore, the purpose of this invention is to offer the manufacture approach of a long picture-like optical compensation sheet that the optical compensation sheet of a large area which an angle of visibility is expanded and does not have image nonuniformity can be manufactured efficiently industrially, when it is used for a liquid crystal display.

[0011]

[Means for Solving the Problem] The above-mentioned purpose the coating liquid which comes to dissolve a liquid crystallinity discotheque compound in a solvent The process continuously applied to the orientation film front face of the long picture-like transparence resin film equipped with the orientation film under conveyance, By heating the process which evaporates a solvent under control while carrying out the seal of the front face of the formed spreading layer in a gas layer, and the spreading layer which evaporated most solvents It can attain by the manufacture approach of the long picture-like optical compensation sheet which consists of considering as the liquid crystal layer of a discotheque pneumatic phase.

[0012] The desirable mode of the manufacture approach of the above-mentioned optical compensation sheet is as follows.

1) Along the front face of a spreading layer, move the seal of the gas layer of the above-mentioned spreading layer front face so that it may become the relative velocity of -0.1-0.1m/second to the passing speed of a spreading layer about a gas.

2) The reduction rate of the content of the solvent in a spreading layer performs at least the process which evaporates the above-mentioned solvent under control within time amount and the period in proportionality (namely, it carries out in the part or all the range within this period).

3) The coating liquid of the above-mentioned liquid crystallinity discotheque compound is carrying out 15-50 weight content of the liquid crystallinity discotheque compound.

4) Carry out giving hot blast or far infrared rays to the side which does not have the liquid crystal layer of this transparence resin film for heating of a spreading layer, or by contacting a heating roller.
5) Perform heating of a spreading layer by giving hot blast or far infrared rays to both sides of this transparence resin film.
[0013]
[Embodiment of the Invention] Hereafter, this invention is explained to a detail. The manufacture approach of the optical compensation sheet of this invention has the description to evaporate a solvent under control, carrying out the seal of the front face of a spreading layer in a gas layer (generally air space), after applying to the orientation film front face the coating liquid which dissolved the liquid crystallinity discotheque compound in the solvent, making the long picture-like transparence resin film with which the orientation film was formed convey.
[0014] The above-mentioned manufacture approach is performed from the following process.
1) Sending-out process of a transparence resin film;
2) Formation process of the resin layer for orientation film formation which applies and dries the coating liquid containing the resin for orientation film formation on the front face of a transparence resin film;
3) Rubbing process which performs rubbing processing to the front face of a resin layer, and forms the orientation film on a transparence resin film on the transparence resin film with which the resin layer for orientation film formation was formed in the front face;
4) Spreading process of the liquid crystallinity discotheque compound which applies the coating liquid which dissolved the liquid crystallinity discotheque compound in the solvent on the orientation film;
5) Desiccation process which a spreading layer is dried [process] and evaporates most solvents in this spreading layer;
6) Liquid crystal layer formation process which heats the dry spreading layer to discotheque pneumatic phase formation temperature, and forms the liquid crystal layer of a discotheque pneumatic phase;
7) Process which solidifies a liquid crystal layer (that is, when the liquid crystallinity discotheque compound which quenches after the liquid crystal stratification, and is solidified, or has a cross-linking functional group is used, a liquid crystal layer is made to construct a bridge by optical exposure (or heating));
8) The rolling-up process which rolls round the transparence resin film with which this orientation film and a liquid crystal layer were formed.
[0015] It explains in detail, referring to a drawing. The schematic diagram of the manufacture approach of an optical compensation sheet is shown in drawing 1 and drawing 2. Transparence resin film 4a of the shape of a long picture sent out by long roll (film roll) 5a to sending-out machine 1a of a film is the process of -2 that the coating liquid which contains the resin for orientation film formation with the spreading machine 3 is applied, dry in the stoving zone 5, and a resin layer is formed on a film front face after being conveyed by the drive roll and carrying out dust removing by the surface dusting machine 2 (above 1). The obtained film may move to the following process continuously, and may once be rolled round here.
[0016] It is a process [that dust removing is carried out by the surface dusting machine 9

which the front face of the orientation film which rubbing processing was performed and was formed adjoined rubbing equipment, and was formed by the rubbing equipment which consists of a dusting machine 7 with which the rubbing roller 8, the guide idler 6 fixed to the roller stage by the spring, and the rubbing roller were equipped with transparence resin film 4b which has a resin layer for orientation film formation (above 3)]. Well-known equipments other than the above may be used for rubbing equipment. a process [that the coating liquid by which transparence resin film 4c in which the orientation film was formed was conveyed with the driving roller, and the liquid crystallinity discotheque compound was dissolved in the solvent on the orientation film is applied by the spreading machine 10 (above 4)] -- subsequently The process which heats a spreading layer to discotheque pneumatic phase formation temperature (the residual solvent of a spreading layer also evaporates here), and forms the liquid crystal layer of a discotheque pneumatic phase in the process after making it dry (above 5) (a solvent is evaporated), and the heating zone 11 (above 6).

[0017] It is the process over which ultraviolet rays are subsequently irradiated in the above-mentioned liquid crystal layer with the ultraviolet-rays (UV) lamp 12, and a liquid crystal layer constructs a bridge (above 7). In order to make a bridge construct, it is necessary to use the liquid crystallinity discotheque compound which has a cross-linking functional group as a liquid crystallinity discotheque compound. When a liquid crystallinity discotheque compound without a cross-linking functional group is used, this UV irradiation process is skipped and is cooled immediately. In this case, it is necessary to perform cooling quickly so that it may not be destroyed while a discotheque pneumatic phase cools. Inspection is conducted [whether the optical property of a transparence resin film front face is measured with test equipment 13, and the transparence resin film with which the orientation film and a liquid crystal layer were formed has trouble, and]. Subsequently, the protection film 14 laminates with the lamination machine 15 on a liquid crystal layer front face, and it is rolled round by the take-up motion.

[0018] The aforementioned process as shown in drawing 2, until it creates and rolls round an optical compensation sheet using the film roll which has the once rolled-round resin layer for orientation film formation may be continuously performed by integrated production. Film roll 5b to film 4b which has a resin layer for orientation film formation sends out, it is sent out by opportunity 1b, and the process below a rubbing process is performed like above-mentioned drawing 1 .

[0019] The process of the above 1-8 may be altogether performed continuously like drawing 1 , as shown in drawing 2 , it may be performed in two steps, and it may perform independently the formation process, rubbing process, and liquid crystal layer formation process of a resin layer further. You may carry out by, of course subdividing further.

[0020] The process of the process (above 2) which forms the resin layer for orientation film formation on a transparence resin film is explained in detail, referring to drawing 3 . The above-mentioned process can be performed as follows, for example. With a pump 32, it is sent in the extrusion die 35 which has decompression chamber 35a through a filter 33, and on the transparence resin film 34 (4a of drawing 1) conveyed, being supported with a backup roller 36, it extrudes and the coating liquid containing the resin for orientation film formation in the coating liquid tub 31 is applied from an extrusion die. 39 is a blower. Subsequently, it passes along the conveyance zone 37 which performs initial desiccation, and dries in the stoving zone 38, and the applied transparence resin

film 34 is continuously put into the next rubbing processing. Or it is once rolled round. Generally the distance of the extrusion die 35 and the transparence resin film 34 is 100-300 micrometers, and, generally 200-500Pa of decompression chambers is kept low from atmospheric pressure. A spreading rate has a desirable second in 0.1-1.0m /, and it is desirable to perform desiccation at 70-100 degrees C for 1 to 10 minutes. The viscosity of coating liquid has desirable 1 - 20 mPa-s (25 degrees C), and coverage is 10 - 50 g/m2. It is desirable. Above, although applied with the extrusion die, it can carry out similarly using the wire bar used for formation of the liquid crystal layer mentioned later.

[0021] The sectional view showing the configuration of the extrusion die 35 used for formation of the above-mentioned resin layer for orientation film formation in a detail is shown in drawing 4 . On the stand 42 equipped with the decompression chamber 43 which has the effluent hole 44 and an exhaust hole 45, the extrusion die 41 which has manifold 41a and slot 41b is installed. Coating liquid is supplied to manifold 41a, passes